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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/820,710	03/30/2001	Takashi Kato	684.3166	4478

5514 7590 02/19/2003

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EXAMINER
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AMARI, ALESSANDRO V

ART UNIT	PAPER NUMBER
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2872

DATE MAILED: 02/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/820,710

Applicant(s)

KATO ET AL.

Examiner

Alessandro V. Amari

Art Unit

2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 10 December 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-3,5,7-13 and 37-55 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 37-46 is/are allowed.
- 6) ☒ Claim(s) 1-3,5,10,11,13, 47-55 is/are rejected.
- 7) ☒ Claim(s) 7-9,12 and 53 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-3, 5, 7-13, and 37-54 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In regard to claims 1 and 37, the recitation "at least one lens" is a part of both the first and second imaging optical systems. Thus, the composition of the first and second imaging optical systems is indefinite.

### ***Claim Objections***

3. Claim 49 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 49 has the exact same limitations as claim 1 in regard to the first imaging optical system and the second imaging optical system.

4. Claim 2 is objected to because of the following informalities:

Regarding claim 2, lines 4-5, the phrase, "a mirror having a negative refractive

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-3, 5, 13, 47-50 and 55 are rejected under 35 U.S.C. 102(b) as being anticipated by Shafer et al. U.S. Patent 5,999,310.

In regard to claims 1 and 49, Shafer et al discloses (see Figure 4) a projection optical system, comprising at least one lens (125); at least one concave mirror (124); and at least one diffractive optical element as described in column 5, lines 65-67 and column 6, lines 48-54, a first imaging optical system (122), having said at least one lens (125) and said at least one concave mirror (124), for imaging an intermediate image (126) of an object; a second imaging optical system (139), having said at least one lens and said at least one diffractive optical element as described in column 5, lines 65-67 and column 6, lines 48-54, for projecting the intermediate image onto an image plane (140); and a field optical system (127) disposed between said first and second imaging optical systems.

Regarding claim 2 and 47, Shafer et al. discloses that said at least one lens, said at least one concave mirror and said at least one diffractive optical element have a positive refractive power as shown in Figure 4 and as described in column 5, lines 65-67 and column 6, lines 48-54, respectively, and wherein said projection optical system does not include a lens having a negative refractive power, a mirror having a negative

Art Unit: 2872

refractive power or a diffractive optical element having a negative refractive power as shown in Figure 4.

Regarding claims 3 and 48, Shafer et al. discloses that said at least one lens, said at least one concave mirror and said at least one diffractive optical element include a lens, a concave mirror and a diffractive optical element of a positive refractive power as shown in Figure 4.

Regarding claims 5 and 50, Shafer et al. discloses (see Figure 4) that said first and second imaging optical systems are disposed along a common straight optical axis as shown in Figure 4, and wherein abaxial light from the object as reflected and collected by said concave mirror is caused by said mirror to pass through an outside portion of an effective diameter of said concave mirror as described in column 5, lines 58-61, toward the image plane side as shown in the lens group 122 in Figure 4.

Regarding claim 13, Shafer et al. further discloses (see Figure 4) a field stop (131) adjacent to an intermediate image to be formed by said first imaging optical system.

In regard to claim 55, Shafer et al discloses (see Figure 4) a projection exposure apparatus for projecting a pattern of mask onto a substrate as described in column 3, lines 63-67, said apparatus comprising at least one lens (125); at least one concave mirror (124); and at least one diffractive optical element as described in column 5, lines 65-67 and column 6, lines 48-54.

7. Claims 1-3, 10, 13, 47-49 and 51 rejected under 35 U.S.C. 102(b) as being

Art Unit: 2872

In regard to claims 1 and 49, Foo discloses (see Figure 1) a projection optical system, comprising at least one lens (30a-30g); at least one concave mirror (20a); and at least one diffractive optical element as described in column 2, lines 51-55, a first imaging optical system (20, 30), having said at least one lens and said at least one concave mirror, for imaging an intermediate image (70) of an object; a second imaging optical system (50), having said at least one lens and said at least one diffractive optical element as described in column 2, lines 51-55, for projecting the intermediate image onto an image plane (15); and a field optical system (40) disposed between said first and second imaging optical systems.

Regarding claim 2 and 47, Foo discloses (see Figure 1) that said at least one lens, said at least one concave mirror and said at least one diffractive optical element in column 2, lines 51-55 have a positive refractive power as shown in Figure 1 and as described, respectively, and wherein said projection optical system does not include a lens having a negative refractive power, a mirror having a negative refractive power or a diffractive optical element having a negative refractive power as shown in Figure 1.

Regarding claims 3 and 48, Foo discloses that said at least one lens, said at least one concave mirror and said at least one diffractive optical element include a lens, a concave mirror and a diffractive optical element of a positive refractive power as shown in Figure 1.

Regarding claims 10 and 51, Foo further discloses (see Figure 1) a reflection surface (68) disposed adjacent an intermediate image formed by said first imaging

Art Unit: 2872

said concave mirror is deflected by said reflection surface toward said second imaging optical system as shown in Figure 1.

Regarding claim 13, Foo further discloses a field stop adjacent to an intermediate image to be formed by said first imaging optical system as described in column 3, lines 40-53.

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 11 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shafer et al. U.S. Patent 5,999,310 in view of Kuba U.S. Patent 5,623,365.

Regarding claims 11 and 52, Shafer et al discloses the invention as set forth above but does not teach wherein at least one of diffractive optical elements of said

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the diffractive optical element as taught by Kuba in the projection optical system of Shafer et al in order to correct chromatic aberrations.

10. Claim 54 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shafer et al U.S. Patent 5,999,310 in view of Stanton et al. U.S. Patent 5,631,721.

Regarding claim 54, Shafer teaches the projection optical system as described in claim 48 above and as described in column 3, lines 65-67, but does not teach a device manufacturing method, comprising the steps of, exposing a wafer to a device pattern and developing the exposed wafer.

Regarding claim 54, Stanton et al does teach a device manufacturing method, comprising the steps of, exposing a wafer to a device pattern and developing the exposed wafer as described in column 1, lines 15-19.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the projection optical system of Shafer et al in the method of Stanton et al. in order to increase semiconductor device manufacturing yields.

***Allowable Subject Matter***

11. Claims 37-46 are allowed.

12. Claims 7-9, 12 and 53 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. Claim 7 and 37 are allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest, "a lens having a positive refractive power,



a reflection mirror and said concave mirror, which are disposed in the order mentioned above, from the object side" as set forth in the claimed combination.

Claims 12 and 53 are allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest "at least one of diffractive optical elements of said projection optical system satisfies a relation:  $|L_d/L_{g2}| < 0.2$  where  $L_d$  is the distance between an aperture stop of said second imaging optical system and said diffractive optical element, and  $L_{g2}$  is the distance from an paraxial image plane position of an intermediate image formed by said first imaging optical system, corresponding to an object point position of said second imaging optical system, to an re-imaging plane where the intermediate image is reimaged" as set forth in the claimed combination.

The prior art of record, Shafer et al, Foo and Kuba teach a projection optical system with first imaging optical system with at least one lens, a concave mirror for imaging an intermediate image of an object and a second imaging optical system having at least one lens and an diffractive optical element for projecting the intermediate image onto an image plane and a field optical system disposed between said first and second imaging optical systems. Furthermore, the combination discloses that the first and second imaging optical systems are disposed along a common straight optical axis, and wherein abaxial light from the object as reflected and collected by said concave mirror is caused by said mirror to pass through an outside portion of an effective diameter of said concave mirror, toward the image plane side. However, the combination does not disclose that the first imaging optical system includes at least a

Art Unit: 2872

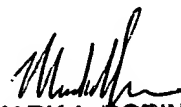
lens having a positive refractive power, said reflection mirror and said concave mirror, which are disposed in the order mentioned above, from the object side. Neither does the combination teach that the diffractive optical elements in the system satisfy the aforementioned optical relationships and no motivation or teaching is present to modify this difference as derived.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alessandro V. Amari whose telephone number is (703) 306-0533. The examiner can normally be reached on Monday-Friday 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cassandra Spyrou can be reached on (703) 308-1687. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

ava *AM*  
February 13, 2003

  
MARK A. ROBINSON  
PRIMARY EXAMINER